SAFETY EVALUATION
SALEM UNIT 2
AUTOMATIC INITIATION AND FLOW AND
STEAM GENERATOR LEVEL INDICATION FOR
THE AUXILIARY (EMERGENCY) FEEDWATER SYSTEM

I. INTRODUCTION & DISCUSSION

To improve the reliability of the auxiliary feedwater system (AFWS), the staff is requiring licensees to upgrade the system where necessary to ensure timely automatic initiation when required. The system upgrade was to proceed in two phases. In the short term, as a minimum, control grade signals and circuits were to be used to automatically initiate the AFWS. This control grade system was required to meet the following requirements from NUREG-0578, Section 2.1.7.a

1. The design shall provide for the automatic initiation of the auxiliary feedwater system.

2. The automatic initiation signals and circuits shall be designed so that a single failure will not result in the loss of auxiliary feedwater system function.

3. Testability of the initiating signals and circuits shall be a feature of the design.

4. The initiating signals and circuits shall be powered from the emergency buses.

5. Manual capability to initiate the auxiliary feedwater system from the control room shall be retained and shall be implemented so that a single failure in the manual circuits will not result in the loss of system function.

6. The a-c motor-driven pumps and valves in the auxiliary feedwater

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system shall be included in the automatic actuation (simultaneous and/or sequential) of the loads to the emergency buses.

7. The automatic initiating signals and circuits shall be designed so that their failure will not result in the loss of manual capability to initiate the AFWS from the control room.

In the long term, these signals and circuits were to be upgraded in accordance with safety grade requirements. Specifically, in addition to the above requirements, the automatic initiation signals and circuits must have independent channels, use qualified components, have system bypassed/inoperable status features and conform to control system interaction criteria, as stipulated in IEEE Standard 279.

In addition to the above automatic initiation requirements, the capability to ascertain the actual performance of the AFWS from the control room must be provided. For Westinghouse plants, this is accomplished by a combination of auxiliary feedwater flow indication and steam generator wide range level indication.

In the short term, the AFWS flow and steam generator level indication is to meet control grade requirements. Specifically, these flow and level instrument channels must be powered from the vital instrument buses, testability of these channels must be a feature of the design, and the instumentation indicating the performance of the AFWS (flow and wide range level indication for each steam generator) must satisfy the single failure criterion. For the long term, to adequately determine the performance of the AFWS, sufficient safety grade instrumentation (specifically steam generator wide range level) must be provided.

II. EVALUATION

The auxiliary feedwater system at Salem Unit 2 is part of the engineered safety features (ESF) and is identical to that of Unit 1. This system consists of two motor-driven pumps and one turbine driven pump. The motor-driven auxiliary feed pumps automatically start upon loss of outside power, loss of main feedwater, safeguards sequence signal or a low-low level signal from one steam generator. The turbine driven pump automatically starts upon loss of outside power or low-low level signals from two steam generators by opening the turbine stop-start valve in the steam supply line. Each motor-driven pump discharges exclusively to two steam generators. The turbine driven pump feeds all four steam generators.

The automatic initiation signals and circuits for the AFWS at Salem Unit 2 comply with the single failure criterion of IEEE Standard 279. Both the turbine and the motor-driven AFWS pumps are tested monthly by manual initiation. The auxiliary feedwater pumps are demonstrated to be operable at least once per 18 months during shutdown by verifying that each pump starts automatically upon receipt of each auxiliary feedwater actuation test signal including loss of offsite power which simulates emergency operation of the system.

The automatic initiation signals and associated circuitry used to actuate the auxiliary feedwater system are part of the engineered safety features actuation system and are powered from the emergency buses. The channels which provide these signals are physically separated and electrically independent. The a-c motor-driven pumps and valves in the AFWS at Salem

Unit 2 are powered from the emergency buses and are included in the automatic sequencing of loads onto these buses.

No single failure within the manual or automatic initiation systems for the auxiliary feedwater system at Salem Unit 2, will prevent initiation of the system by manual or automatic means. The AFWS initiation can be accomplished from either the control room or locally at the pumps.

The pumps, drives, valves, and piping within the Auxiliary Feedwater System have been designed as Seismic Class 1 components. The environmental qualification of all safety related systems including the AFWS is being reviewed by the Equipment Qualification Branch as part of their review of conformance to NUREG-0588, "Interim Staff Position on Environmental Qualification of Safety-Related Equipment."

Capability to ascertain the performance of the AFWS at Salem Unit 2 is provided by flow indication and steam generator level indication in the control room. There is one flow indicator per steam generator and three level instruments per steam generator covering both narrow and wide range. The flow instrument channels receive their power from the Class 1E vital instrument buses. These flow channels are testable and have an accuracy on the order of $\pm$ 2%. The flow transmitters and indicators are safety grade.

In order to adequately determine from the control room the performance of the AFWS, steam generator level instrumentation is used, in addition to flow indication. The requirements for this steam generator level instrumentation are specified in Regulatory Guide 1.97, Revision 2 (R.G. 1.97 - "Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident"). The steam

generator level instrumentation at Salem must be in conformance with these requirements and implemented in accordance with the schedule indicated in the referenced R.G.

III. CONCLUSION

Based on our review of the Salem Unit 2 auxiliary feedwater automatic initiation system, we conclude that the initiation signals and associated circuitry comply with the long term safety grade requirements of NUREG-0578, Section 2.1.7.a and the subsequent clarification issued by the staff, and therefore, are acceptable.

Our review of Salem Unit 2 flow indication instrumentation has concluded that this instrumentation complies with the long term safety grade requirements of NUREG-0578, Section 2.1.7.b, and the subsequent clarification issued by the staff, and therefore, is acceptable.